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STORABILITY OF RICEBEAN SEEDS

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Storability of ricebean (*Vigna umbellata* (Thunb.) Ohwi & Ohashi) seed was studied over a 5 year period under ambient and +5°C temperature. 12 genotypes of the 1991 season differing in seed characteristics namely seed size and coat pigmentation were chosen for the study. Both storage environment and genotype affected seed germination, seedling vigour and storability. At ambient temperature vigour and viability declined gradually during the 3-3.5 year storage period. Thereafter the decline was somewhat abrupt. At 5°C there was no significant decline in the seed viability. Different accessions differed in their storability. Seedling vigour and storability was related to seed size. Bold seeds and those with dark seed coats deteriorated slowly during storage than small and light coat colour seeds. Accessions with lighter seed coat colour showed higher leachate conductivity and water uptake.

Key words : Ricebean, storability, variation

Genetic differences in the storage potential of different species are well recognised with species such as soybean and onion deteriorating rapidly compared to mungbean and rice. Research with several crops suggest that different genotypes within a species may have different storage characteristics. Differences in the storage potential of cultivars within species of grain legumes have been found to be associated with various seed characteristics. Singh *et al.*, (1972) reported a differential rate of viability loss among soybean genotypes stored under ambient conditions in Northern India. Small seeded cultivars were, in general, found to loose viability less rapidly than large seeded cultivars. In long bean (*Vigna sesquipedalis*) and soybean, cultivars having unpigmented seed coats deteriorated more rapidly during storage than cultivars with pigmented seed coats.

Ricebean (*Vigna unbellata* (Thunb.) Ohwi & Ohashi) is a promising economically important crop in the tropics. High yield and high degree of resistance to diseases in comparison to other pulses has made it more popular and acceptable to farmers in some regions than other traditional pulse crops like mung and urid bean. Information on seed storability is not available in this crop. The objective of this experiment was to study the storability of ricebean and the variation among genotypes differing in various seed characteristics.

MATERIALS AND METHODS

Seeds of 12 ricebean genotypes of 1991 harvest were drawn from 90 germplasm accessions grown at NBPGR Regional Station, Bhowali. These were graded dark and light coloured seed groups. All accessions showed an initial moisture content of 8-9 per cent. Seeds were dried to moisture levels of 7-7.5 and sealed in laminated aluminium foil packets. These seeds were stored at ambient and +5°C temperature. Periodically seeds were assessed for germination and vigour

at 6 month interval. Germination was tested by placing 200 seeds in two replicates of 100 seeds each BP at 25°C and observations were taken following ISTA (ISTA, 1985). Vigour was observed as radical length after 120 hrs at 25°C. At least 20 seeds were used per accession for vigour estimation.

Leakage of solutes including electrolytes from 10 weighed seeds into 25 ml of distilled water was determined after 24 hr imbibition at 20°C by measuring the electrical conductivity of the seed soak water (Powell and Mathews, 1979). Rate of water uptake was measured by immersing 10 seeds in 10 ml of distilled water at 25°C. Seeds were removed from water after 8 hrs, blotted dry and weighed. Change in weight due to imbibition were expressed in terms of per cent weight increase as compared to air dry weight of seed.

The data were analysed statistically.

RESULTS AND DISCUSSION

The initial germination of various ricebean accessions varied from 90-100 per cent and the 100 seed weight varied from 7.1- 10.2g, (Table-1), seed viability, seedling vigour and storability were significantly affected by storage temperature. Seed germination declined gradually in all the accessions during the 3-3.5 year storage period at ambient temperature of Delhi (Table 2). Thereafter the decline was somewhat abrupt. At 5°C, seeds were able to maintain initial percentage germination for a storage period of 5 years. Statistical analysis of the germination data throughout the storage period at ambient temperatures revealed highly significant differences between accessions and storage periods. Seed germination after 5 years of storage at ambient temperature were 77, 69 and 58 per cent in IC 25032B, EC 18111A and IC 73138B whereas only 23 and 30 per cent viability was recorded in IC 25032C and IC 73142B respectively after the same storage duration. The variation in storability at ambient temperature was more conspicuous with respect of accession differing in seed coat pigmentation. Also decline in germination was found to be negatively correlated to 100 seed weight (Table 4).

Table 1. Initial germination and other seed traits of Rice bean accessions

Accession No	100 seed wt(y)	Hard seeds %	Testa colour	Initial germination %
EC18111A	7.1	2	Black	96
EC 4852B	8.1	2	Choclate	94
IC 25032 C	10.1	4	Choclate	90
IC 73138B	8.3	1	Chocolate	92
IC 37219D	8.1	4	Chocolate	94
IC75522B	7.2	0	Chocolate	100
EC 37219 C	8.8	3	Green mottled	96
IC25032 B	8.0	0	Green mottled	98
EC 988 C	8.8	8	Green mottled	90
IC 25032A	7.6	2	Light green	98
IC 73142 A	10.2	0	Light green	100
IC 73142 B	7.6	3	Light green	94

Seedling vigour expressed as radicle lengths (Data were taken at six month intervals, however only summary is presented here) was also effected by storage temperature and followed a trend similar to seed germination. Radicle lengths at ambient temperatures were positively correlated with 100 seed weight of accessions (Table 3).

Leachate conductivity increased with age in all the accessions and was negatively correlated with seedling vigour. There were significant differences in the leachate conductivity and water uptake among the different accessions. Accessions with lighter seed coat colour showed higher leachate conductivity and water uptake.

Table 2. Seed germination during storage of Ricebean seeds

	Storage period (years)									
	Ambient							5°C		
Acc. No.	1	2	3	3.5	4	4.5	5	3	4	5
EC 18111A	95	90	88	82	80	78	69	95	95	94
EC 4852B	94	92	83	74	68	60	54	94	93	94
IC 25032B	96	90	84	84	84	80	77	90	89	87
IC 73138B	92	90	79	71	68	63	58	92	92	91
IC 37219D	93	91	81	75	64	58	51	92	89	86
IC 75522B	100	96	90	81	70	52	43	100	99	97
EC 37219C	96	93	82	76	62	56	48	96	96	95
IC 25032C	90	94	88	78	65	42	23	90	90	90
EC 988C	90	86	80	65	56	51	48	90	90	91
IC 25032A	97	91	88	79	75	53	39	97	98	95
IC 73142A	100	98	88	72	59	54	34	100	100	100
IC 73142B	94	90	86	82	71	54	30	94	93	92

Table 3. Vigour, leachate conductivity and water uptake in accessions of Ricebean

Acc.No.	Initial radical length mm	Radical length after 5 years	RL after 5 years at 5°C	Initial EC	EC after 5 years of storage at ambient	Weight increase in % after 8 hr imbibition
EC 18111A	80.36	24.9	78.5	440	551	8.43
EC 4852B	86.0	26.7	85.4	378	595	6.75
IC 25032B	93.3	34.1	92.7	290	534	4.21
IC 73138B	74.0	29.4	72.8	459	503	4.81
IC 37219D	70.8	33.5	69.7	152	778	9.54
IC 75522B	98.3	24.4	98.1	358	667	6.26
EC 37219C	96.7	24.1	95.9	716	1141	15.29
IC 25032C	82.6	20.5	82.4	146	928	12.24
EC 988C	75.4	21.2	74.7	396	1276	14.61
IC 25032A	96.9	19.1	94.3	387	1988	25.21
IC 73142A	80.23	8.3	79.1	486	1506	23.95
IC 73142B	81.7	18.8	80.2	361	1379	27.44
CD at 5%	1.66	0.20	NS	.05	17	1.5

Variation in the storage potential of ricebean accessions was found to be particularly associated with seed coat colour. Accessions having light seed coats showing poor storage potential in comparison to those having dark coats. Accessions having better storage potential also showed superior vigour characteristics. Differences in longevity of seeds within the same species have been noted

Table 4. Correlation co-efficients between various seeds traits

Character	100 seed weight	Wt increase due to water uptake	Leachate conductivity	Radical length after 5 years	Seed coat colour	% germination
Hard seeds	0.135	0.019	0.238	0.182	0.177	0.194
100 seed wt		0.925**	-0.778**	0.832**	-0.662*	-0.041
Water uptake			-0.720**	0.844**	-0.626*	0.130
Leachate conductivity				-0.753**	0.740**	0.109
Radical length					-0.725**	0.115
Coat colour						0.320

by several investigators. James *et al.*, (1964) observed that seeds of some vegetable varieties stored for 15-30 yrs maintained a high degree of viability while other varieties of the same species stored under identical conditions were either dead or of very low viability. Varietal differences for decline in germination over the storage period have been found to be associated with various seed characteristics in different crops (Tiwari and Gupta, 1981; Juliano *et al.*, 1990). Many workers have noted that snapbean cultivars with coloured seed produced stronger and more vigorous seedlings than those with white seeds. Also cultivars with colored seed appeared to be more vigorous throughout the growing season and were adaptable to adverse conditions than white seeded cultivars (Deakin, 1974). Presence of phenolic compounds may cause greater seedling vigour. However this is not a universal explanation because some cultivars with pigmented seed coats also exhibit poor germination characteristics. Previous studies in soybean (Kueneman, 1983) and longbean (Abdullah *et al.*, 1991) have suggested that the more rapid decline in germination & vigour of unpigmented cultivars during storage was partly the result of their rapid uptake of moisture from the humid atmosphere. However, in cowpea (Asiedu and Powell, 1998) unpigmented cultivars were genetically more predisposed to rapid deterioration since they also deteriorated more rapidly when cultivars were held at a high constant moisture content. This genotypic predisposition to more rapid deterioration would be enhanced by their more rapid increase in moisture content at high relative humidity. Bold seeds deteriorated slowly during storage and showed better vigour than the small seeds. Similar trend has been reported by (Tiwari and Gupta, 1981) in sunflower.

Differences in vigour among ricebean accessions were evident using vigour tests including the electrical conductivity test which measures the levels of electrolytes leached into soak water as a function of the membrane permeability. The conductivity test has also been useful in identifying varietal differences in vigour of field bean (Hegarty, 1977) soybean (Oliveira, Mathews and Powell, 1984) and Peas (Mathews and Powell, 1981). variation in water absorption among genotypes would be a reflection of the differences in the seed coat properties viz. thickness and dry weight. Varietal differences in moisture absorption have also been reported by Chatterjee *et al.*, (1981). Results reported here show that ricebean is a good storer with most of the accessions showing above 50% viability after 4.5 years of storage even at ambient temperatures. At 5°C viability is maintained close to original even when seeds are stored at 7- 7.5% moisture level. The variation in storability and associated seed traits can be usefully considered in further studies.

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